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Gray for his exertions in securing for the Society the herbarium of the late Dr. Short, of Louisville, Ky.

Dec. 8th.

DR. CARSON, in the chair.

Twenty members present.

The following paper was presented for publication:

"On some new and singular intermediate forms of Diatomaceæ." By F. W. Lewis, M. D.

Dr. Morris mentioned that a nest of owls, Strix pratincola, had been found in the turret of a church on Rittenhouse Square.

Dec. 15th.

The President, Mr. LEA, in the Chair.

Thirty-two members present.

The following paper was presented for publication:

"Synopsis of the Species of Hosackia." By Asa Gray.

Dec. 22d.

The President, Mr. LEA, in the Chair.

Sixteen members present.

The following was presented for publication:

"Synopsis of the Echinoids collected by Dr. W. Stimpson." By A. Agassiz.

Dec. 29th.

The President, Mr. LEA, in the Chair.

Twenty-nine members present.

On report of the respective Committees, the following papers were ordered to be published in the Proceedings:

On some New and Singular Intermediate forms of DIATOMACEÆ.

BY F. W. LEWIS, M. D.

About three years ago I made a gathering from the marsh bordering a shallow pond, situated in the Notch Valley, (White Mountains,) from the Southern end of which the Saco river takes its rise. This pond is fed by numerous mountain streams of small size, which nearly always dry up during the heats of summer. Its principal source of supply is in the springs which well up from beneath the morass, in the centre of which the pond lies.

This gathering was principally composed of particles of the adjacent rocks, mixed with some vegetable debris. It contained both Diatomaceæ and Desmidiæ in abundance. To the former of these alone I propose directing attention, not only on account of the singularity of their departure from established generic types, but also because of certain points of great speculative interest illustrated by their peculiar grouping, and the unique and isolated nature of the deposit in which they occur.

My friend, Prof. L. W. Bailey, of Frederick, N. B., who is at this time devoting himself specially to the study of the interesting question of the geological bearing of the Diatomaceæ in determining the relative antiquity of fossil beds in the State of Maine and the adjoining country, in a letter to me of some time back, alludes to the fact of the extreme rarity of the genera *Synedra* and *Nitzschia* in any of the *sub-peat* deposits of the northern section of the United States, although, as he adds, both are quite common in surface gatherings.

His observations I understand to apply to sub-peat (fresh water) deposits alone, and not to the mixed class of alluvial deposits like the Hudson and Delaware river muds, or, in fact, to any foreign post tertiary deposits as those of Mull and Glenshira, which in many respects differ from cotemporaneous beds in this country.

My own experience agreeing with Prof. Bailey's so far, at least, as regards the rarity of these genera in the sub-peat of this country,* the discovery of the forms contained in the Saco pond was peculiarly interesting to me, as it seemed to foreshadow the abundant introduction of the Synedroid genera, by presenting a series of intermediate types between these and *Surirella.*

In advancing my theory of the geological and structural position of these new species, I must premise, however, that it is, in a great measure, founded on a conjectural basis, and from the very nature of the points involved, insusceptible of positive proof. I shall, therefore, in describing these species, confine myself to a brief notice of the principal facts which appear to me to sustain my views, reserving for a future occasion the consideration of such collateral evidence as I may have derived from other sources, but which the limits of the present paper forbid my here introducing.

This gathering, as before stated, was derived from the margin of a pond supplied by the springs which feed the river Saco. The position of this pond and its surroundings I am particular in describing, for reasons which will be apparent hereafter. It lies on the eastern side of the Crawford intervale, and is surrounded by other and smaller ponds, which dry up during the summer. It is about 200 feet long, rather less in width and very shallow. At its southern extremity is the outlet of the small streamlet which forms the begining of the Saco river. A few small mountain brooks empty into it laterally, but the main source of its supply appears to be certain springs welling up from underneath the alluvial detritus forming the pond bottom, which overlies a thin stratum of clay, beneath which is the boulder drift. A sparce growth of grass fringes the northern margin of the pond, and on its southern and western aspect is a boggy patch with a good deal of moss, but this appears to be quite superficial, and at a few inches below the surface is the same alluvial till without much vegetable debris. Similar conditions of soil seem to hold at other points in the valley. It is in this fine and soft mud, at from one to four inches below the surface, beneath and immediately around the waters of the pond, that the silicious remains of the new species are most abundant.

The gathering is principally remarkable for two points :

Firstly. The striking analogy which exists between its species and those of the sub peat deposits of the northern section.

Secondly. The occurrence of several forms belonging to a known genus—*Surirella*—so peculiar and variable in their characters as almost to merit the title of *transitionary*, by which term I mean that these forms may be regarded as just such aberrant varieties of that genus as we might expect to find conducting to the *Genera Nitzschia* and *Synedra*, which, on this continent, appear to have followed the genus *Surirella* at a long interval of time. They exhibit, moreover, such very unusual variation, both as to size, configuration and definition of distinctive character; such want of generic fixity, to so express it, as might be supposed likely to mark the incoming of new Genera.

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* *Synedra ulna*, *S. radiaris*, *S. lunaris*, *S. biceps* and two or three species of *Nitzschia* occur sparingly in several sub-peat localities.

Although there may exist reasonable ground for doubt as to whether the lines which separate two of these genera (*Surirella* and *Amphipleura*,) or some of their species, are not founded on structural degradation, rather than on true and definite characteristics, the evidence I have to offer is, as yet, not sufficiently digested to make it in any respect conclusive of the matter. It will be briefly stated hereafter in the consideration of species. In the meantime I prefer to consider these eccentric members of the Surirellæ as illustrations of the " *Comprehensive* " type of *Dana*, (*Synthetic* of Agassiz,) which he explains to be "one which embraces, along with the characteristics of the group to which it belongs, others of another group, and usually at its first appearance this group is not in existence." "It is in part" (he adds,) an "*intermediate* type between two groups, although never occupying the middle point, as it always belongs fundamentally to one of the two, while partaking of some of the characteristics of the other. This comprehensive type, moreover, becomes extinct with the progress of the system of life, while the types which it foreshadowed, or partly comprehended in itself, are long afterwards perpetuated," and such, to all appearance, has been the fate of these curious intermediate links between the genera in the present case.*

In conformity with this definition of the comprehensive type, a careful comparison of these Nitzschoid and Synedroid varieties has convinced me that all of the doubtful and imperfectly defined species really belong to *Surirella* ; even the necessity of creating a *Subgenus* for their accommodation being obviated by the clearly marked progressive series of intermediate forms connecting the normal type of *Surirella* with the most aberrant varieties in the Saco mud.

The species first to be described I have named after the late Prof. Bailey.

I. SURIRELLA BAILEYI, n. sp. F. V. Oblong linear, with rounded extremities. V. linear lanceolate, slightly attenuated near the central portion, with the rounded apices more or less produced. Alæ conspicuous. Canaliculi well marked ; striæ usually distinct up to the well defined central line. Owing to the great variation both in the number and fineness of the striæ and canaliculi, I have not attempted to estimate their average. *Habitat*: in the soft mud about and under the roots of the grass at the north end of the pond. The silicious valves occur, as is the case with nearly all the succeeding species, in greatest abundance at from two to six inches below the surface.—Fig. 1, a, and b.

This form is rare in the gathering. It is an exceedingly elegant little species. The smaller valves of what I believe to be the same form, bear a superficial resemblance, in outline and punctulation, to *Nitzschia* the alæ and canaliculi becoming so much dwarfed as to be nearly invisible. A careful manipulation of the valve dispels this apparent similarity, reducing both lines of seeming puncta to the same plane, and also defining their structural value as alæ.

Although no doubt can exist as to the claims of this species to rank as a *Surirella*, I have preferred to first describe it before proceeding to the forms hereafter to be noticed, which depart widely and eccentrically from the type of the genus in question, for the reason that some of its varieties serve as an introduction to these latter, whose anomalies they, in a measure, explain.

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* Manual of Geology, page 395.

Therefore, before leaving *S. Baileyi*, I desire to call attention to the Synedroid* character of the smaller varieties, together with their apparent degradation of generic character, as points which will be found intensified in the species next to be described.

II. SURIRELLA INTERMEDIA, n. sp. Frustules free. Valve linear, strongly sigmoid with attenuate rounded apices. F. V. straight or slightly sigmoid, expanding at the subtruncate extremities. *Alæ* usually distinct, twisted near the ends of the valve, giving rise to a spathulate appearance. Canaliculi numerous, inconspicuous, reaching the narrow central blank line. Striæ distinct, variable as to number and fineness, as in *S. Baileyi*. For the same reason I have not estimated their average. Fig. 2, a, and b.

Var. β. With the same general outline, only much smaller. Alæ and canaliculi rudimental. Occurs in groups of from two to five; probably sporangial.

This remarkable species, more curious and anomalous in its character than the preceding, is quite abundant in the pond. For a good while I was disposed to regard it as an aberrant variety of *Nitzschia* or *Amphipleura*, but a more careful study of the structure of the valve led me to refer it to *Surirella*.

The points of resemblance which seem to me to place it in that genus are: the presence of *well-marked alæ* and of tolerably distinct *canaliculi*, structural appendages never found in *Synedra*, *Nitzschia* or *Amphipleura*, to which genera *S. intermedia* is allied by external configuration and curvilinear attenuate proportions. Of a certain superficial resemblance to the punctulation of *Nitzschia*, visible in the small frustules of what may be regarded as the sporangial brood of *S. intermedia*, it is hardly necessary to speak, as a careful study of the intermediate varieties of this diatom shows that these seeming puncta are, in reality, only miniature alæ.

Before going further, it may be as well, for convenient reference, to give the definitions of those genera most nearly allied to this species and its varieties. In order that the relative importance of their respective points of resemblance to the new species may be more readily apprehended, I have italicized those special characters of each genus represented in *S. intermedia*:

Surirella.	*Synedra.*	*Nitzschia.*	*Amphipleura.*
(Says Prof. Smith,) is distinguished by the following characters: " *Frustulus free*, ovate or elliptical. *Valves* with a *longitudinal central line* and *margins produced into alæ. Canaliculi distinct*, usually parallel." He further adds that, "It is well distinguished from *Tryblionella* by the prominence of its alæ and the usual cuneate form of its frustules.—*With no other form is it likely to be confounded.*"	" *Frustules elongated wand like*, attached by the lower end. *Lateral surfaces equal to or less than the front view: traversed by a smooth line.*" (Last character omitted by Prof. Smith.)	"Frustules *free*, *elongated*, compressed. "*Valves linear*, keeled with one or two longitudinal lines of puncta. " Keel frequently eccentric."	"Frustules *free*, *linear*, with *longitudinal ridges*."—(Vide *Surirella anceps*. n. sp.) Generic characters admitted to be obscure by Prof. Smith.

It will be seen, by reference to the italicized portion of these definitions, that although the characters belonging to these genera, represented in *S. intermedia* are about equal in *number*, this is far from being the fact as regards their structural significance, which in the case of those noted in *Surirella* is much more considerable than in any of the others.

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* I employ the term "Synedroid' here and elsewhere in this notice, to designate these forms, as, although the apparent punctulation in some of them is more suggestive of *Nitzschia* than of *Synedra*, they never present any trace of keel.

Considered as *generic*, these characters may be classed as *essential* and *non-essential*. The *former* of these divisions embraces such structural characters as *median* and *terminal nodules*, *central lines*, *alæ*, *costæ* or *canaliculi*. These appear to bear to their parent organism a relation somewhat similar to that held by the tracheæ and stigmata of insects or the nutritive vessels of plants in their own sphere. Among them the susceptibility to variation is notably less than in the *latter* or non-essential class, in which may be placed such shifting and superficial characters as *size*, *external configuration*, *striation*, &c. These ought more properly to be regarded as mere accidental phenomena, constantly modified by agencies depending on climate, locality, soil, and the mineral constitution of the water which contains the diatomaceous growth.

This tendency to extreme variation in these non-essential characters is forcibly illustrated everywhere throughout this country by the strange modifications of size, shape, striation, punctulation, and even condition of aggregation, observable in such species as *Navicula firma* and *N. rhomboides*, under differing conditions of locality and reproductive agencies.*

Assuming, then, that all these variations in size, shape, striation, &c., when observed in Diatomaceæ, are *non-essential* phenomena, let us review the facts relating to the species under consideration. We have here a form, which, by virtue of the possession of two of the most invariable and *essential* of generic characters, viz., *alæ* and *canaliculi* is allied to *Surirella*, one of the most ancient and widely distributed of known genera, and to *Nitzschia*, *Synedra* and *Amphiplcura*, more modern and weaker genera, by the *non-essential* character of external configuration, and in the case of *Amphipleura* by the occasional presence of submarginal ridges, a resemblance only observable, however, in the smaller or sporangial brood ol *S. intermedia* and *S. anceps*, n. sp., hereafter to be described. To *Nitzschia*, the likeness ot these smaller frustules is more marked, and I am disposed to think that the form figured in Prof. Gregory's paper on Fossil Diatomaceæ. (Trans. Mic. Soc. No. viii. Mic. Journal,) as *Nitzschia sigmatella*, may be an undeveloped specimen of the present species. From *Nitzschia*, however, the absence of any trace of keel, together with the fact of the arrangement of the marginal puncta upon the same plane, sufficiently removes *S. intermedia*. From these facts it seems probable that this curious diatom is in reality a *transitionary* or *comprehensive type species* which, along with other forms in the gathering, themselves *comprehensive*, departing more or less widely from the typical *Surirella* and tending towards the Synedroid type, has resulted under certain peculiar and exceptional circumstances while the modern peat was being deposited.

To explain the apparent anomaly of the presence and perpetuation of this assemblage of influences in this particular locality, will be my endeavor when proceeding with the description of the species, although I am fully aware that my premises, founded on the presumed geological relations of the Saco deposit to the sub-peat and to the surface soil are, as previously stated, not fairly proven.

As a preliminary, I may state those conditions which appear to be essential to the developement and fixity of this and other intermediate forms constituting so unique and eccentric a grouping in the Saco mud.† These may be assumed to be:

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* My friend Prof. H. L. Smith, of Ohio, informs me that he has found *N. rhomboides* in the condition of a Colletonema.

† It may be urged that in the foregoing remarks on these species and their relations to the typical *Snrirella*, I have advanced the idea of gradual generic transmutation, rather than the true theory of the *comprehensive type*, which implies no such *serial* progression as is apparent in the present instance. To this objection I would observe that, while no such serial progression is implied, neither is it inconsistent with this theory; for the intermediate type differs from a subgenus, not only because it does not transcend the *essential* characters of genus, but for the reason also, which makes it superior to ordinary species and varieties, viz., that it possesses pecu-

Firstly. "A low grade in the scale of organic life, implying great capacity for variation.

Secondly. "A long period of time during which these exceptional forms could have been produced and perpetuated."

The first of these conditions will be readily admitted ; the *second*, however, which touches more directly on my hypothesis, requires some notice. Several considerations might be urged in proof, of which the most important seem to me to be the following :

1. "The absence of these comprehensive forms in the *sub-peat* deposits, and also as *recent* species elsewhere."

2. " The general resemblance of most of the living species of the Saco pond to those found in the sub-peat, and the very partial representation of genera common in surface gatherings in the neighborhood and elsewhere." This general resemblance must not be understood as implying that the Saco species, or many of them at least, are not to be found as living forms in other streams and ponds in this country, but that the proportion grouping and prevailing varieties of species common to both do not correspond ; at the same time, as before stated, surface genera, such as *Nitzschia*, *Tryblionella*, *Cymatopleura*, *Cocconema*, *Epithemia*, *Odontidium*, *Amphipleura*, &c., are either absent or but feebly represented in the Saco.

3. "The occurrence of irregular and eccentric forms having no analogues in either fossil or recent deposits. Such a one is *Actinella*, (new genus, hereafter noticed,) and others of the new species, together with species not hitherto found living in this country or elsewhere, I believe, as *Eunotia hemicyclus* (Ehr.) *Eunotia incisa* (Gregory) and singular varieties of *Himantidium*.

The presence of an abnormal or irregular type like *Actinella punctata*, a form which seems to have nearly disappeared from other localities as a living species, is not perhaps so much a direct evidence of a long continued chain of modifying causes as it is of an intermediate, but no longer (elsewhere) active assemblage of influences.

In this connection, and in view of the apparent contradiction involved in the continued operation of these influences in the present case, I now proceed to state more distinctly the explanatory hypothesis founded on the probable geological relations of the Saco deposit to the subjacent formation.

It is that these forms represent a series of *intermediate species* peculiar to the modern *peat*, and more specially to its earlier history, occurring only under exceptional circumstances, their continuance as living organisms in the Saco being accounted for by favorable influences derived from the thin stratum of boggy soil, till and clay, which overlies the valley drift, and through which well up the Saco springs, whose waters may thus in *transitu* acquire properties by virtue of which, conjointly with other exceptional local causes, species and varieties, no longer existing elsewhere, may continue io flourish.

I may be excused for citing one or two facts which lend plausibility to this somewhat fanciful hypothesis, viz., the isolated nature of the deposit on which the forms occur, and the comparative absence of the contained species on the surface of the mud which paves the pond, as well as upon the growth of grass and moss which lines its margin. Although several smaller ponds lie in the immediate neighborhood, one being separated by a few yards only from the Saco, in no case have I succeeded in finding in any of them specimens of these new species, of *Eunotia hemicyclus*, *E. incisa*, or even of *E. diadema*, a common Saco form. This same remark holds good also with regard to several small mountain brooks which empty into the pond

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liar relations to another genus towards which some subtle, natural force, some intrinsic bias, is impelling it.

This bias, constituting the very essence of the intermediate type, it would seem to matter but little, should the forms expressing it be single or several between a group, sub-group, family or genus ; or whether they represent a series more or less progressive, providing that the *essential* limits of the natural division to which the type belongs be not overstepped.

from the west and north, the Diatomaceæ found in all these being principally such genera and species as are found in most northern localities. I may add that the Saco stream, at a short distance from its point of emergence from the marsh, contains none of the new species. From these facts it seems reasonable to infer that the local conditions which favor the development of these are confined to a circumscribed area. Further, that these conditions do not depend on any peculiarity in the vegetable growth which lines the margin and extends for a short distance into the pond, is highly probable, as this seems to be in all respects similar to that surrounding the streams and ponds adjoining; nor can it be said that there is any characteristic peculiarity of the surface soil serving to distinguish it from that elsewhere found in the valley bottom, in which I have vainly searched for the silicious remains of these organisms.

These facts of exclusion, in my opinion, go far to prove that the causes which have perpetuated these varieties depend in no small degree on the mineral constitution of the springs up-flowing from under the valley "muck" or till, of which I am assured only a superficial covering overlies the boulder drift at this point, and also, perhaps, to telluric impressions derived indirectly from other sources.

In further corroboration of this view, I refer to the presence in the gathering of the living *Eunotia hemicyclus*, a species which has heretofore only occurred in fossil deposits, of *Eunotia incisa*, also a fossil form, and to the greater abundance and larger size of the siliceous valves of the new species at from two to five inches below the surface mud. This is particularly the case with regard to *Surirella anceps*, next to be described, the remains of which are rarely met with in any quantity at a less distance than two inches below the pond bottom.

I shall reserve for future consideration whatever corroborative evidence of the long period of time required in the production of these forms is afforded by the tendency to extreme variation manifest in nearly all the species, and by the disposition shown by some of them to assume a punctate arrangement, such as characterizes *Actinella punctata*, and to a less marked degree *Tabellaria* in the deposit.

III. SURIRELLA ANCEPS, n. sp. The species now to be noticed I have referred to *Surirella*, not without hesitation. Frustules free, linear, F. V., straight or very slightly sigmoid. V. Sigmoid, elongated with rounded subacute extremities (in outline singularly vermiform.) Alæ very small (sometimes nearly obsolete) or submarginal: canaliculi very inconspicuous, often wanting: *striæ*, very sharp and clear, extending to the wide and well defined central space which runs from end to end of the V. [Over the *inner* aspect (?) of the valve the striæ appear to be continuous, or this phenomenon may be exceptional. I have frequently met with valves in which the striæ were uninterrupted and have been unable to focus anything resembling a central line or even traces of alæ, and this fact has induced me to think that the thickness of the substance of the valve may have prevented my doing so.] Color of dry frustule, rich chesnut-brown.

This species is quite as common as the preceding, although not as a living organism. It occurs most abundantly in the mud which envelopes the roots of the grass and plants at the northern end of the pond, and appears to be an older species than *S. intermedia*, and I may add, a stronger one, as notwithstanding the remarkable subordination of generic character and the evidence of greater degradation from its type visible, it is less variable, both in size, outline, and striation than this latter. Fig. 3, a and b.

The slight and imperfect development of the alæ and canaliculi in this species requires a careful management of light to enable their being viewed satisfactorily. They are best seen by using a condenser of moderate angular aperture.

The rudimental alæ, which in the Fig. 3, a, are represented as marginal, occasionally assume a submarginal position, and when this occurs in the smaller valves, it would be difficult for any one not familiar with the larger varieties to distinguish them from *Amphipleura sygmoidea*, to which species the resemblance is very marked. The brackish habitat and much finer striation of this latter diatom, however, make it impossible that they can be identical.

In Fig. 3, b, the peculiar arrangement of the alæ is tolerably well shown, as rendered from the dry valve. These it will be seen are feebly defined, and, owing to their somewhat exceptional (for *Surirella*) relations to the valvular surface, present an inverted appearance. Viewed from what I believe to be the inner aspect of the valve, they are hardly distinguishable from puncta, and occasionally seem to be obsolete. Owing to the brittleness of the connecting membrane, it is difficult to get a front view of the frustule, excepting in the recent specimen, and the valve is best studied by burning this upon a thin glass cover.

IV. SURIRELLA DELICATISSIMA, n. sp. The next species is exceedingly minute and variable. Frustule straight. F. V. Linear slightly inflated with rounded ends. V. linear lanceolate, sometimes centrally constricted, with produced, rounded, or subacute extremities. Alæ marginal, inconspicuous; canaliculi obsolete; striation very delicate.

This very minute form is abundant both in the Saco and Wolfboro' muds; but being feebly silicious and the valve highly refractive, it is apt to be overlooked in acid-boiled and balsamed specimens. It varies greatly in outline and definition of alæ. The Fig. 4, a, b, represents the most usual form. The marginal lace-like border is very elegantly displayed, in the larger frustules burnt on glass.

This species is specially interesting, as approximating a step nearer the Synedroid type, in the absence of canaliculi, and the attenuated form of the valve.

It may ,perhaps, turn out to be an early stage of *S. Baileyi*. The specimen figured is magnified 1000 diameters.

I now pass on to consider a very curious and anomalous diatom nearly allied to *Eunotia*, and more remotely to *Asterionella*, but with points of difference from either, so decided as, in my opinion, to require its isolation in a separate genus. This, from the radiant arrangement of the frustules, I propose terming "ACTINELLA," nov. gen. "Frustules linear arcuate, with an unequally notched inflation at one extremity, and terminal nodules, usually forming, by the adherence of the smaller ends, a stellar grouping."

V. ACTINELLA PUNCTATA, n. sp., is the only species yet found. Frustules linear, arcuate, commonly in radiating, symmetrical clusters of from six to twelve individuals. "F. V. straight, slightly cuneate, narrowing gradually from the extremities towards the centre; ends more or less truncate. V. arcuate with a well marked notched inflation at the free extremity, smaller (attached) end rounded, with terminal nodules and sharp convergent striæ, and a row of marginal puncta." Habitat on the surface mud. Fig. 5, a, b and c.

The idea first suggested by the singular irregularity of development in this diatom, is rather that of accidental deformity, than that of definitive and permanent character, and this view I was disposed to adopt, until after the discovery of specimens altogether identical, from another and distant locality.

Like most of the Saco species, *A. punctata* enjoys a very extended range of variation in size, length, proportion, definition of striation and punctulation; in no case, however, has the distinctive peculiarity (the unequally notched inflation) been found absent. Indeed, so invariable is it that a few worn valves, in the mud, dredged from Wolfboro' inlet, (Lake Winnipisseogee), at least sixty miles distant from the Saco pond, present this same special character; and recent gatherings, after a period of three years, show no difference in this respect.[*]

The peculiar notched inflation, which appears to be a fixed character of this diatom, equally with the tendency to punctate arrangement observable in several species in the gathering, possesses a certain significance, as showing how strongly a dominant *Nitzschoid* (*Synedroid*) leaning exists throughout the group. I have before alluded to the disposition to marginal punctulation evident in *A. punctata*, *Tabellaria flocculosa*, and one or two doubtful smaller forms in the Saco mud, as affording probable illustration of a sympathetic intrinsic force, tending towards the *Nitzschoid* type. In *A. punctata* there would seem be, as it were, a double exercise of this attractive force, conducting, not an allied form, but one only remotely connected with it, towards the same type. The antetype in the present case would appear to be *Eunotia*, between which and the *Synedroid* genera this anomalous form constitutes an intermediate or comprehensive link.

Eunotia (*monodon* to *polyodon*) is the prevailing form in the gathering. It occurs with every peculiarity of dorsal prominence, from a faintly perceptible undulation to the sharpest and most serrate crenature, a fact singularly opposed to the experience of the late Prof. Gregory, who limited this tendency to vary to the two species, *E. bigibba* and *triodon*. Now this disposition to extreme variation, even in *non-essential* characters like the above, in species not ordinarily variable, concurring with a comprehensive type like *A. punctata*, induces me to think that these varieties of *Eunotia*, illustrate a series of successive approaches to the *Nitzschoid* type, which has culminated in the case of *E. polyodon* in the abnormal and irregular genus I am describing. This, had it not been for the peculiar mode of its growth and aggregation in stellar groupings, would have ranked as an aberrant *Eunotia*; and, in fact, before meeting with the living form, I had distributed specimens under the name of *Eunotia fibula*. It has the arcuate form, terminal nodules and convergent striation, which usually characterizes that genus, and presents some curious points of analogy to the prevailing species, *E. polyodon*, in respect to the resemblance between the notched inflation of *A. punctata*, and the two terminal undulations of the valve in the former diatom. The ventral or concave aspect of both is similar, or nearly so, and the terminal nodules and striation do not materially differ. By suppressing all the dorsal elevations, excepting the terminal one at one end of *E. polyodon*, and attenuating the valve, a form in outline nearly identical with *A. punctata* is obtained. In suggesting this resemblance, I do not wish to imply that *Actinella* has resulted by progression or degradation from this or any other species of *Eunotia*, but merely to infer the possibility that, in accordance with the laws which govern the comprehensive type, the non-essential character of dorsal crenulation common to the latter genus and its ally *Himantidium*, is becoming merged into the smooth lines of the Synedroid genera.[†]

To *Asterionella* this form presents very few points of resemblance. The mode of growth is somewhat similar, but the frustules are essentially different. Both, it is true, are bacillar forms, and possess unequally developed ends; but the valve of *Asterionella* is straight and symmetrical, while that of *Actinella* is curved and unequally bifid at the larger end, which is free, and not, as in case of the former genus, attached to its fellows by the adjacent angles.

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[*] In this connection and in corroboration of the view before advanced, I may state that the Wolfboro' mud was taken from a stream whose bottom has relations to the valley drift very similar to those of the Saco deposit. Besides *A. punctata* I have been able to identify three of the Saco n. sp. in this mud, viz., a degenerate variety of *Surirella intermedia*—*S. delicatissima*, with generic characters still more repressed—and a third form too imperfectly characterized to admit of present classification.

[†] A further illustration of this bias towards the Synedroid type is afforded in the case of *Himantidium gracile*, in this gathering, whose frustules are in many cases so attenuated and dehiscent as to render it difficult, if not impossible, to distinguish them from those of *Synedra*.

The group of frustules, moreover, is not always symmetrical, or arranged upon the same plane.

VI. TRYBLIONELLA? or DENTICULA? n. sp.

The form figured at No. 6 of the plate occurs sparingly in this deposit, and more abundantly in the Wolfboro', but not in sufficient quantity to enable me satisfactorily to determine its true generic position. It seems to be solitary. Providing it be not a *Denticula*, its analogies to *Tryblionella* are stronger than to any other genus. The valvular surface is transversely and continuously striate, with no indication of a central line. The costæ are marginal.

This diatom is very minute.

Leaving a further consideration of this curious species, to which I hope to be able to return on a future occasion, I shall briefly conclude this somewhat protracted notice, by calling attention to one or two points in connection with the mode of growth and extreme variation of a few of the known species in the Saco mud.

(1.) *Eunotia hemicyclus* I have sometimes found growing like *Synedra lunaris:* several frustules attached to a fixed point. *E. hemicyclus* is not abundant in the gathering, and varies somewhat in the amount of its curve. The extremities are usually bevelled off into a subacute conical point. (2.) *Surirella intermedia*, in its smaller sporangial or embryonic form, commonly occurs in groups of from three to four parallel frustules. I have not found it in bundles like *Homeocladia* or *Colletonema*, but the position of the frustules is somewhat suggestive of those thalloid growths. *Navicula rhomboides* is similarly arranged. It presents a remarkable range of variation, as does *N. firma*. (3.) *Eunotia incisa* is very variable in outline and striation. It shows a tendency to unequal development at the extremities. These varieties or anomalies I propose figuring in a paper on the Diatomaceæ of the River Delaware blue clay, to be shortly presented to the notice of the Academy, and which was originally intended to be combined with the present communication.

I have, in noticing these species, purposely placed them in the order in which they occur, beginning with that most remote from the Synedroid type, and ending with those which approximate most nearly to *Synedra*. Whatever opinion may be entertained concerning the theory of the geological position of these forms, will not, I think, materially invalidate the following points, which are fairly deducible from the premises:

(1.) That the species and varieties in this deposit are singularly like, like those of the sub-peat.

(2.) That there is a notable absence of surface genera—*Nitzschia*, *Amphipleura*, *Tryblionella*, *Cymatopleura*, *Fragillaria*, *Odontidium*, &c., &c., all of which occur in adjacent localities.

(3.) That certain exceptional forms are present, which appear to represent types intermediate between the fossil *Surirella* and *Eunotia*, and the more modern genus, *Synedra* (and *Nitzschia?*), *Surirella Baileyi*, *S. intermedia*, *S. anceps*, *S. delicatissima*, illustrating the synthesis in the case of the former, and *Actinella* in the latter, (*Eunotia.*)

(4.) That these forms are exceedingly rare, and seem to be confined to localities having peculiar conditions of soil, which, in all likelihood, depend on the mineral constitution of the water percolating through it.

(5.) That there is an unusual tendency to variation in nearly all the species, and a strong disposition shown by some of them to become attenuate and elongated, and also to assume a marginal punctate arrangement, suggestive of a Nitzschoid bias.*

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*I may add that this same tendency to extreme variation affects the Desmidiæ which abound in this locality. This is particularly the case with *Triploceras verticillatum*, (Bailey), which beautiful and showy Desmid presents every variety of outline and proportion reconcileable with specific identity. The prevailing variety differs from that fixed by Bailey, in the more unguiculate character of the terminal horns, and the inclination of the knot-like prominences.

(6.) That there is reason to suppose that these species are nearly extinct as living organisms; although to what extent they may have flourished in a previous epoch, and how universally have been diffused, can only be a matter for speculation, until further and more thorough investigations in this, and other localities, shall have been made.

References to Plate.

(1.) Surirella Baileyi, a, V. b, F. V. n. sp.
(2.) " intermedia, a, V. b, F. V. "
(3,) " anceps, a, V. b, F, V. "
(4.) " delicatissima, a, V. b, F. V. "
(5.) Actinella punctata, nov. gen. a, V. b, F. V. c, group of frustules × 100 d.
(6.) Denticula? or Tryblionella, n. sp.
(7.) Amphora intermedia, n. sp.
(8.) Navicula, n. sp.
(9.) Mastogloia elegans, n. sp.
(10.) Amphiprora pulchra, Var. B. = A. conspicua (Greville).

These are all magnified about 500 d, excepting *Surirella delicatissima*, which is amplified to 1000 d. The Figs. from 7 to 10, inclusive, illustrate a paper on the Diatomaceæ of the Delaware River and marine localities adjacent thereto, which will be submitted to the Academy in a short time.

Synopsis of the species of HOSACKIA.

BY ASA GRAY.

§ 1. SYRMATIUM, Vogel. (*Drepanolobus*, Nutt.) Legume small, subulate or caudately attenuate, often torose, incurved or sickle-shaped, 1–4-seeded. Keel of the corolla not attenuate upwards, mostly obtuse. Claws of the petals slightly exserted or included; that of the vexillum somewhat distant from the others. Perennial herbs or suffruticose plants, or one species annual. Leaves 3—7-foliolate, with a very short petiole and rhachis. Stipules in the form of small black glands. Flowers small, in sessile or short-peduncled umbels, yellow, or sometimes whitish, often changing to reddish.

* Shrubby or suffruticose, with rigid slender branches, glabrous or glabrate, the young parts often silky puberulent, with (3—5, commonly 3) small and thick leaflets, somewhat sempervirent.

1. H. JUNCEA, Benth. in Linn. Trans. 17, p. 366. Shrubby, erect, bushy-branched, broom-like, with obovate, oval, or oblong leaflets, and very short peduncled few-flowered umbels; the calyx-teeth extremely short and blunt!—California. The only specimens before me are an original one of Douglas' collection, and those of Dr. Brewer, recently collected in the mountains near San Luis Obispo, in the Geological Survey of California.

2. H. SCOPARIA, Nutt. (under *Drepanolobus*), in Torr. & Gray Fl. *Syrmatium glabrum*, Vogel, in Linnæa, 10 (1836), p. 591. Almost wholly glabrous, shrubby, erect, 2—8 feet high, very bushy-branched and broom-like; with linear-oblong or barely oblong (obtuse or acute) leaflets, and strictly sessile umbels, which are usually crowded along the flowering branchlets, so as to form a virgate interrupted inflorescence. Teeth of the calyx subulate and acute, varying from one quarter to nearly half the length of the narrow tube. California, common from San Francisco to San Diego.

Var. DIFFUSUS (*H. crassifolia*, or *Drepanolobus crassifolius*, Nutt., l. c.), is a